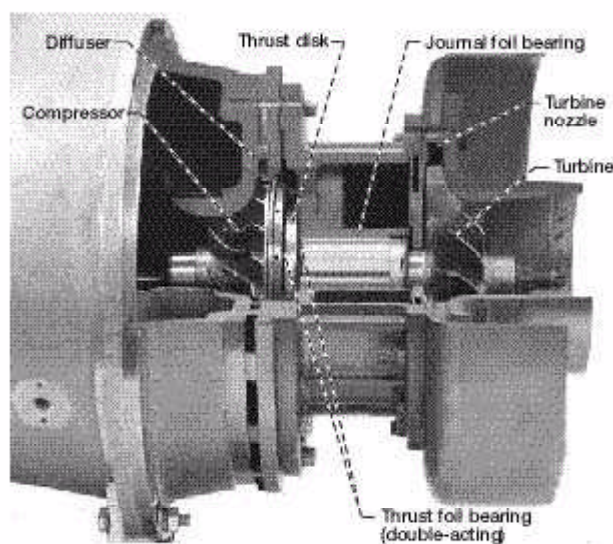


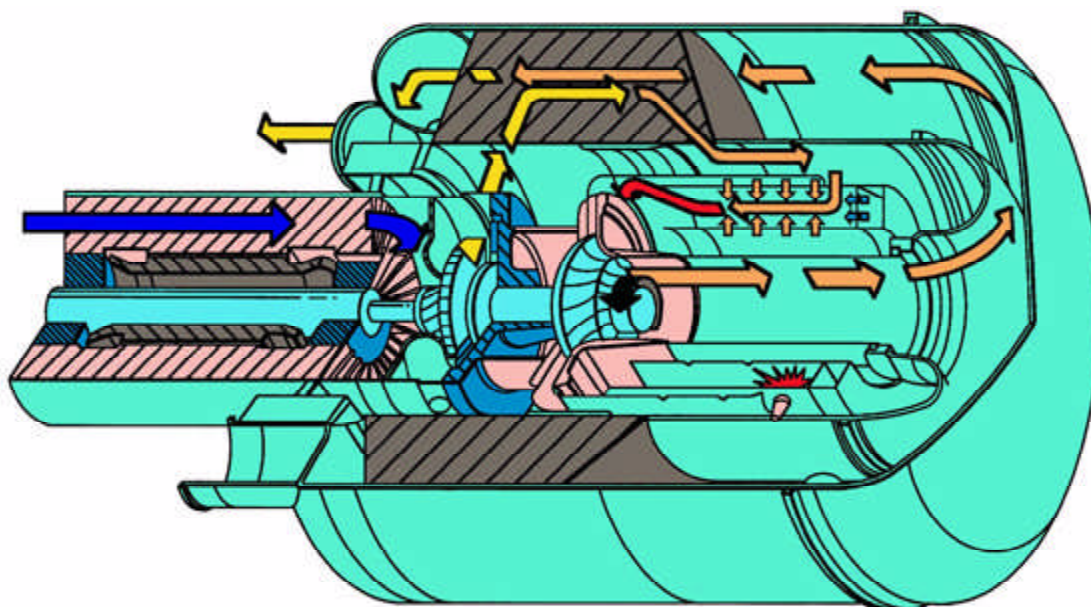
NASA PS304 Lubricant Tested in World's First Commercial Oil-Free Gas Turbine



Capstone microturbine installed in lab.



Cross-section cutaway photographic view of Oil-Free turbine engine.



Cross-section cutaway illustration of generator and engine.

In a marriage of research and commercial technology, a 30-kW Oil-Free Capstone microturbine electrical generator unit has been installed and is serving as a test bed for long-term life-cycle testing of NASA-developed PS304 shaft coatings. The coatings are used to reduce friction and wear of the turbine engine's foil air bearings during startup and shut down when sliding occurs, prior to the formation of a lubricating air film. This testing supports NASA Glenn Research Center's effort to develop Oil-Free gas turbine aircraft propulsion systems, which will employ advanced foil air bearings and NASA's PS304 high-temperature solid lubricant to replace the ball bearings and lubricating oil found in conventional engines. Glenn's Oil-Free Turbomachinery team's current project is the demonstration of an Oil-Free business jet engine. In anticipation of future flight certification of Oil-Free aircraft engines, long-term endurance and durability tests are being conducted in a relevant gas turbine environment using the Capstone microturbine engine. By operating the engine now, valuable performance data for PS304 shaft coatings and for industry's foil air bearings are being accumulated.

The Capstone microturbine is a gas-turbine-driven electrical generator unit manufactured by the Capstone Turbine Corporation (Chatsworth, CA) and is an ideal test bed for the NASA coating technology because it uses foil air bearings and operates at high shaft speeds (up to 96 000 rpm) and temperatures. These conditions are very similar to those expected in future Oil-Free aeropropulsion engine applications. The Capstone microturbine is the world's first commercially available gas turbine engine to use this Oil-Free bearing technology.

In addition to applying PS304 coatings to the engine shafting, other modifications to the system were made that allow the electrical power output to be captured. While the facility is testing PS304 shaft coatings, the 30-kW of electrical power generated is being phase

and frequency matched and put back onto the local utility grid instead of wasted via dissipative heating. The microturbine test rig was activated in May 2002 and has logged over 1200 hr of testing near peak operating conditions to date. At regular intervals, the engine will be dismantled for inspection then reassembled for more testing. Aircraft gas turbines are designed to run for up to 20 000 hr, and it is anticipated that the Capstone microturbine will provide nearly double that valuable technology test time over the next several years.

Find out more about Oil-Free Turbomachinery research

<http://www.grc.nasa.gov/WWW/Oilfree/>.

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